

1. Introduction and Overview

2 In the second office action Claims 1-3, 8-10, 12, 14 and 15 were rejected;
3 the rejection was made final by Examiner. Claims 4, 7, and 13 were objected to.
4 Claim 11 was allowed.

5 Claims 1-3, 8-10, 14 and 15 were rejected under 35 U.S.C. 103(a) over
6 **Ramarathnam US Patent No. 6,316,895 B1** in view of **Joyner, Jr. et al US**
7 **Patent No. 4,308,491**. Claim 12 was rejected under §103(a) as being
8 unpatentable over **Ramarathnam** in view of **Slate et al US Patent No.**
9 **4,919,596**. Claims 4, 7 and 13 were objected to as being dependent on a
10 rejected base claim (Claim 1). **Ramarathnam** and **Joyner, Jr. et al** constitute
11 new references cited by Examiner.

12 A brief summary of **Ramarathnam**, **Joyner, Jr. et al** and **Slate et al** is as
13 follows:

14 **Ramarathnam** teaches a controller utilizing pulse width modulation
15 (PWM) to generate a variable frequency and variable amplitude sinusoidal
16 waveform used to vary the speed of an AC induction, reluctance or synchronous
17 motor. In **Ramarathnam's** scheme the frequency of PWM is **not** the driving
18 frequency of the motor as in the applicants' case, but is several times higher.
19 **Ramarathnam's** PWM is used to generate a sine wave input to the motor
20 wherein the higher the frequency of the PWM, the more accurately sinusoidal is
21 the drive to the motor. Obtaining high sine wave fidelity is an explicit goal in
22 **Ramarathnam**. The inventor explicitly states (pg.1 lines 29-32) that "... it is
23 necessary to ensure that the output waveforms are as near to sinusoid as
24 possible to minimize harmonic effects and reduce losses, noise and vibration. "
25 (*Note: Ramarathnam's invention primarily addresses 3-phase induction motors*
26 *for which a separate waveform is generated for each phase.*) In fact, one of the
27 aims of **Ramarathnam's** invention (page 2 lines 64-66) is to "vary the magnitude
28 and frequency of the applied voltage, while keeping the output waveform of the

1 inverter as close to sinusoidal as required." While the frequency of each of
2 **Ramarathnam's resultant sine waves is the driving frequency of the motor, the**
3 **frequency of PWM used to generate the sine wave is not.**

4 It is noted that **Ramarathnam** discloses that in addition to controlling AC
5 motors his scheme is also applicable to brushless DC motors (col. 3, lines 36-
6 37). This would only be possible if the DC motor is modified so that the AC signal
7 is applied directly to the field windings. In this case the motor ceases to operate
8 in the conventional DC mode and can no longer be called a "DC motor" even
9 though specified as such in **Ramarathnam**.

10 **Joyner, Jr. et al** teach a pumping system wherein a plurality of pumps are
11 driven by a plurality of variable speed AC motors controlled by a "control box".

12 **Slate et al.** teach a feedback controlled fluid delivery and control
13 apparatus incorporating DC motors and a piston pump embedded into a
14 disposable output cassette for accurately delivering fluid to a patient. **Slate et al**
15 do not teach a "fountain system."

16 Before addressing the specific reasons for rejection in the office action, it
17 is first necessary to address the issue of permanent magnet synchronous AC
18 motors as addressed by Examiner in the second office action, Section 1, page 2.
19

20 **2. Regarding Permanent Magnet Synchronous AC Motors (OA**
21 **Section 1)**

22 It is noted that in applicants' original disclosure and thereafter in
23 Amendment A and in the current amendment, applicants have limited Claim 1
24 and 3 and amended claims 1 and 3 to AC permanent magnet synchronous motor
25 pumps. The motor portion of these pumps is structurally different and internally
26 functions differently than other AC synchronous motors not having permanent
27 magnet rotors.

1 Examiner states (OA section 1 page 2) that "... all synchronous AC motors
2 or synchronous DC brushless motors have permanent magnet rotors." No
3 authority is given for this statement. If this statement were true, then in original
4 Claim 1 and Claim 2 and in currently amended Claim 1 and amended Claim 3,
5 applicants' limiting the motor pump to permanent magnet rotors would be moot -
6 e.g. specifying "permanent magnet" would be just as meaningfully limiting as
7 specifying the color that the motor housing is painted.

8 The above-cited statement of Examiner is not correct in two respects:

9

10 **2-A. DC Motors**

11 The term "synchronous DC brushless motors" has no meaning.
12 A DC motor by definition cannot be synchronous, as there is no component
13 within a pure DC supply to which the motor can synchronize. Applicants made a
14 similar argument in Amendment A to counter Examiner's contention that
15 applicants' motor was a brushless synchronous DC motor. It is however possible
16 to drive many types of brushless DC motors as AC motors by bypassing the
17 internal electronic commutation mechanism, in which case the motor effectively
18 becomes an AC motor. When driven as such from an AC source, the motor can
19 no longer be considered to be a DC motor. The specific reference to DC
20 brushless motors in Ramarathnam's disclosure requires that the above
21 modification be made in order for Ramarathnam's AC drive to function.

22

23 **2-B. AC Motors**

24 There are a number of examples of brushless AC synchronous
25 motors that do not have permanent magnet rotors and these are well known art.
26 One type is the very common reluctance-type synchronous motor. Motors of this
27 type typically have "non excited" iron rotors with specific shapes designed to
28 channel the induced magnetism into paths which synchronize the rotor to the

1 rotating field produced by stationary field coils. There are also types with a
2 construction similar to "squirrel cage" induction motors but with certain sections
3 of the cage removed to achieve fixed magnetic polarization of the rotor at normal
4 running speeds.

5 Another form of brushless AC synchronous motor without a
6 permanent magnet rotor is the hysteresis motor. In this type of motor the rotor is
7 typically a smooth hard steel cylinder with high magnetic retentivity. In operation,
8 the field coils induce a magnetic field into the rotor. This field will tend to remain
9 static with respect to the rotor at low torque. These types of motors are common
10 in clock drives. All three of the above types of motors are generally small and
11 are used only in low torque applications.

12 Additionally, there is a class of brushless AC synchronous motors
13 not having permanent magnet rotors that is typically used in large-scale
14 applications such as in ship propulsion pods. In these motors the magnetic
15 polarizing energy for the rotor is developed by AC generator windings attached to
16 the main motor shaft which rotate within a static magnetic field generated by an
17 external excitation current. The AC current from these rotating generator coils is
18 rectified within the rotor assembly and fed to windings embedded in the main
19 rotor to provide the fixed magnetic polarization for the rotor.

20 There are many variations of these types of motors, none having
21 permanent magnet rotors, as well as other types which either by magnetic
22 induction or by other means produce magnetic fields in the rotating part of the
23 motor without the use of brushes or other forms of electrical (as distinct from
24 magnetic or optical) contact with the rotor.

25

26 **2-C. Applicants' AC Synchronous Motor Pump**

27 The term "motor pump" has been used throughout applicants' disclosure
28 (see, for instance applicants' disclosure pg. 3, lines 7-11) as has the term PMSM

1 pump (see, for instance applicants' disclosure pg. 8, lines 8-11) to refer to a
2 pump comprised of an AC permanent magnet synchronous motor having an
3 internal magnetic rotor and coupled impeller (see applicants' disclosure, pg. 4,
4 lines 27-28 through pg. 5, lines 1-2). Applicants' AC PMSM pump is an integral
5 unit. Limiting the motor pump to an AC permanent magnet synchronous motor
6 pump in Claim 1 and Claim 3 and amended Claim 1 and amended Claim 3
7 distinguishes from the general class of AC synchronous motors without
8 permanent magnet rotors that are used to drive **physically separate** pumps.
9 Many of these motors without permanent magnet rotors are multi-horsepower,
10 many are three-phase and the majority are rigidly shaft-coupled to high flow rate
11 pumps. (Note that some of these have flexible - rather than fixed - couplings to
12 obviate shaft mis-alignment).

13 Permanent magnet synchronous motor pumps on the other hand are
14 designed to be submersible and are generally fractional horsepower, have low
15 flow rates (typically less than 2000 gallons- per- hour) and are designed for a
16 100% duty cycle. These integral motor-pump units are used extensively in
17 aquarium and small fountain applications since by design the rotor and the
18 impeller are immersed in a common liquid (e.g. water). (Note that "sump pumps",
19 which typically do not have permanent magnet rotors, do not have this feature
20 and generally are designed for intermittent duty).

21 Advantageously, for AC PMSM pumps, liquid immersion prevents the rotor
22 bearing system from overheating. Further, to avoid startup problems, these motor
23 pumps generally allow the rotor and impeller to rotate between fixed stops
24 relative to each other. Significantly, the rotor and impeller are normally **not** rigidly
25 fixed to one another. These distinctions are important to applicants' arguments
26 for allowance to follow.

27

28

3. Rejection of Claim 1 under §103(a) over Ramarathnam in view of Joyner, Jr. et al is overcome

Applicants have amended Claim 1 to more clearly annunciate the novel and non-obvious features over **Ramarathnam** in view of **Joyner, Jr. et al** and to further distinguish over the prior art.

In Claim 1 and Claim 1 amended, applicants specify an AC permanent magnet synchronous motor pump (emphasis added). It is clear from this description that the magnetic rotor and impeller are part of the integral motor pump. This would obviate a permanent magnet synchronous motor, for example, which is coupled via a shaft to a separate pump which in turn includes an impeller. The language of Claim 1 and amended Claim 1 clearly announces this point. In no place in applicants' disclosure is there mention of a separate motor and pump. In Examiner's rejection of Claim 1, Examiner states that "it would have been obvious ... to use Ramarathnam's motor to run Joyner's pump to achieve the same subject matter as claimed." Since Claim 1 and amended Claim 1 specify the control of a motor pump which is both structurally and functionally integrally combined, and **Joyner, et al** teach a plurality of separate pumps driven by a plurality of separate AC motors, the claimed feature of Ramarathnam's "motor" used in place of Joyner's motors to drive Joyner's pumps is lacking in Claim 1 and amended Claim 1. Further, **Ramarathnam** and **Joyner, et al** are individually complete and functional within themselves.

Ramarathnam discloses a controller for generating sinusoidal waveforms to drive an AC motor. **Joyner, et al** discloses a pumping system comprised of variable speed AC motors and separate pumps controlled with a "control box". There would be no reason to substitute **Ramarathnam's** motor controller for **Joyner's** "control box" to vary the speed of **Joyner, et al's** motors unless the suggestion came from applicants' own disclosure viewed in hindsight. Finally,

1 **Ramarathnam** does not teach a motor - he teaches a motor controller. These
2 arguments argue against §103(a) rejection.

3 It is appropriate to spell out the major differences between applicant's
4 amended Claim 1 and the teaching of **Ramarathnam**.

5 **Ramarathnam** describes a method of generating sine waves using cyclic
6 PWM to drive an AC motor. In **Ramarathnam**'s disclosure, the motor driving
7 frequency is the sine wave frequency and **not** the PWM frequency. This is an
8 important distinction between applicant's disclosure and amended Claim 1 (see
9 **Ramarathnam** Fig. 4) and **Ramarathnam**'s teaching.

10 In **Ramarathnam** the motor is driven by a waveform produced by a
11 PWM waveform of much higher frequency than the driving frequency. This PWM
12 frequency is typically at least 4x to 5x and more likely an order of magnitude or
13 more higher than the driving frequency. The waveform in **Ramarathnam** is
14 specifically tailored to produce with reasonable accuracy an AC sine wave of the
15 type for which the motor was specifically designed, e.g. an AC sine wave such as
16 is supplied with a common AC power line supply. Such an approach of
17 generating sinusoidal waveforms using cyclic PWM is common practice.
18 Importantly, it is noted that even for a given motor speed, the frequency of the
19 PWM in **Ramarathnam** is not of necessity related to the output frequency sine
20 wave or to motor speed. That is: In **Ramarathnam**'s case the PWM frequency is
21 clearly not linked harmonically to motor speed whereas the sine wave that the
22 PWM generates is harmonically related.

23 In applicants' disclosure and in amended Claim 1 the motor driving
24 frequency is the PWM frequency which is the synchronizing mechanism and is
25 therefore directly related to the motor pump speed. Note that in applicants'
26 disclosure (page 9, lines 21-24) the frequency, f, which is specified, is the
27 frequency of the output pulse waveform driving the motor pump. For a
28 synchronous AC motor, the speed of the motor **must** be in synchronization with

1 this frequency (see **Walker** technical definition quoted below). It is well known in
2 AC motor art that a synchronous motor synchronizes to the predominant, lower
3 frequency component (this is the driving component) of the applied waveform. In
4 **Ramarathnam** this is the sine wave component of the multi-component
5 waveform. In the applicants' amended Claim 1 it is clear that there exists only
6 one predominant frequency component which **is** the driving component. The AC
7 pulse switching signals of amended Claim 1 are not a sine wave and amended
8 Claim 1 neither explicitly or implicitly describes the generation of such a
9 waveform as taught in **Ramarathnam**.

10 The following definitions of *synchronous motor* and *synchronous machine*
11 are in order: In Walker, P., Ed (1988) Chambers Science and Technology
12 Dictionary. Chambers/Cambridge. New York. pg. 878, a synchronous motor is
13 defined as an "A.c. electric motor designed to run in synchronism with supply
14 voltage." Such motors retain synchronization with the **frequency** of the voltage
15 applied to the motor. Further, a synchronous machine is defined in Walker as "
16 An a.c. machine which rotates at a constant speed which is harmonically related
17 to the frequency of the supply to which it is connected. If the machine is two pole,
18 it will rotate at the supply frequency: if 4 pole, at half supply frequency, and so
19 on." (pg. 878). In other words, the harmonic relationship is solely related to
20 driving frequency and to the physical characteristics of the motor (i.e. the number
21 of poles).

22 In applicants' disclosure a specific aim of the invention was to vary the
23 flow rate of an AC PMSM pump by varying the frequency input to (driving) the
24 motor pump and by correspondingly varying the pulse width such that the motor
25 pumps power requirements are met over the widest range of motor pump
26 speeds realizable (see applicants' disclosure pg. 3, lines 7-11, emphasis added).

27 Amended Claim 1 spells out these distinctions explicitly with the following
28 language: " *varying the flow rate of said motor pump over an extended range*

1 *of flow rates in accordance with AC pulse switching signals applied to said motor*
2 *pump further comprising means setting the frequency of said AC pulse switching*
3 *signals for obtaining a given speed of said motor pump, wherein said speed is*
4 ***synchronous to said frequency for all realizable speeds of said motor***
5 ***pump...."*** (emphasis added, see above pg. 13, lines 23 – 28, pg.14, line 1).

6 It is noted that amended Claim 1 patentably distinguishes from the pulse width
7 modulation used by Ramarathnam to generate a sinusoidal waveform.

8 Further, amended Claim 1 specifies means of setting the pulse width in
9 relation to the driving frequency with the following language: "... *further*
10 *comprising means setting the pulse width of said AC pulse switching signals in*
11 *relation to said frequency for a given motor speed in order to maintain constant*
12 *and continuous flow for any given realizable speed of said motor pump...."*

13 In Ramarathnam the PWM changes cyclically with the motor revolution.
14 (e.g. the pulse width is proportional to the amplitude of the relevant part of the
15 generated sine wave at any given moment in time) for any given fixed motor
16 speed. In applicants' disclosure and amended Claim 1 the pulse width remains
17 constant for a given fixed motor speed and pulse width changes (e.g.
18 modulation) only occur as the intended motor speed changes.

19 The above distinctions, enunciated in amended Claim 1 strongly
20 distinguish over Ramarathnam and the prior art.

21 Amended Claim 1 eliminates a major element of Ramarathnam - that is
22 the computationally intensive generation of the higher frequency PWM waveform
23 used to produce the lower driving frequency sinusoidal waveform required to
24 synchronously drive the motor. Applicants' simplification - only AC pulse
25 switching signals at the synchronous driving frequency are generated - makes it
26 possible to control the AC PMSM pump of Claim 1 over a wide speed range
27 while greatly reducing controller processor requirements. This simplification is
28 important in terms of economic considerations and is a compelling argument in

1 overcoming potential §103(a) rejection of amended Claim 1. Novelty, because
2 this simplification reduces computational demands on the microprocessor of
3 amended Claim 1, applicants' processor program cycles at a considerably lower
4 rate (therefore resulting in a much lower task overhead) for a given processor
5 (micro controller) type and speed. Consequently more time is available for the
6 processor to complete other tasks (e.g. A to D conversion, control program
7 sequence, user input, external control code decoding etc.). This obviates having
8 to rely upon a more powerful or second processor to perform such work.

9 Applicants' invention enunciated in amended Claim 1 also constitutes an
10 unsuggested modification to the invention of **Ramarathnam**. In fact,
11 **Ramarathnam** teaches in the other direction - that is - arguing toward obtaining
12 higher sine wave fidelity balanced by processor constraints. This is another
13 argument in overcoming potential §103(a) rejection.

14 Applicants' invention as enunciated in amended Claim 1 is also contrary to
15 the teaching of the prior art and is a strong argument against potential §103(a)
16 rejection. For example, it is natural to assume that since AC motors are
17 designed to run on a sinusoidal waveform from the AC line, one should attempt
18 to reproduce that waveform as closely as possible in any mechanism designed to
19 effect a speed change by changing frequency. That is exactly what
20 **Ramarathnam's** invention spells out. (See Amendment B, section 1 and
21 **Ramarathnam** page 1 lines 29-32). In contrast, applicant's invention and
22 amended Claim 1 specify a much simpler approach by driving the motor pump
23 directly and in synchronism with the AC pulse switching signal frequency for all
24 realizable speeds of the motor pump. Novelty, this approach significantly reduces
25 computation-time overhead.

26 The invention has been implemented in hardware and software by
27 applicants' and results in exceptional control of the AC PMSM pump of amended
28 Claim 1. This could be viewed as an unexpected and surprising result -

1 especially in light of **Ramarathnam** - since applicants' pulse switching signals
2 differ markedly from a sinusoidal waveform. Since **Ramarathnam** is primarily
3 concerned with the control of large three-phase induction motors where the
4 sinusoidal waveform issue is more relevant, the approach in **Ramarathnam**
5 would be substantial overkill if used to control the low torque, low power AC
6 PMSM pumps of applicants' invention. This is yet another argument against
7 potential §103(a) rejection of Claim 1.

8 Novelty, applicants' combination of motor driving supply frequency
9 control and Pulse Width Modulation control is used to considerably extend the
10 working speed range over which an AC synchronous motor pump can be usefully
11 varied in an economically cost effective manner. The invention is thus novelly
12 and perfectly suited to control low cost, low flow rate AC PMSM pumps.
13 Applicants submit that amended Claim 1 defines patentably over **Ramarathnam**
14 and the prior art and is now in a condition for allowance.

15

16 **4. Rejection of Claim 3 under §103(a) over Ramarathnam in view of**
17 **Joyner, Jr. et al is overcome**

18 Applicants have amended dependent Claim 3 incorporating the AC
19 permanent magnet synchronous motor pump of cancelled Claim 2 with further
20 limitation. Amended Claim 3 specifically limits to AC permanent magnet
21 synchronous motor (PMSM) pumps wherein both rotor and impeller are
22 immersed in a common liquid. This type of pump is normally submersible,
23 however such pumps can be operated outside of a liquid environment by
24 providing suitable liquid-tight couplings for inlet and outlet liquid. In this type of
25 pump the motor and the pump form an integral unit. This is referred to in
26 applicants' disclosure as a "motor pump". These motor pumps are typically
27 fractional horsepower and, as pointed out in applicant's disclosure, are generally
28 used in fountain applications.

1 In rejecting Claim 2 based on §103(a), Examiner states that
2 **Ramarathnam's** motor is an AC permanent magnet synchronous motor which
3 can be used to run **Joyner's** pump to output a flow of liquid. Applicants will
4 respond to this statement since cancelled Claim 2 with further limitation has been
5 incorporated into amended Claim 3. **Ramarathnam** teaches a motor controller -
6 not a motor. **Joyner** teaches a pumping system where a plurality of variable
7 speed AC motors and a plurality of separate pumps are controlled by electronics
8 in an associated "control box". Each of these references cited by Examiner is
9 complete within itself. While **Ramarathnam's** motor controller could conceivably
10 be used to control each of **Joyner's** motors, such combination could only be
11 made in hindsight in view of the applicants' own disclosure. Further, use of
12 **Ramarathnam's** controller to replace **Joyner's** control box and external circuitry
13 (see **Joyner, et al** Fig. 2) would require substantial and not necessarily
14 straightforward modifications for such use to be operative. Additionally, amended
15 Claim 3 comprises an **integral** motor pump - not separate motors and pumps as
16 in **Joyner**. Finally, applicants note that even if **Ramarathnam** taught an AC
17 PMSM, combining such a motor to replace each of **Joyner's** motors would not
18 meet the subject matter of amended Claim 3.

19 Applicants will now address the rotor/impeller issues explicit in Examiner's
20 rejection of Claim 3. In rejecting original Claim 3, Examiner notes that for
21 "motor/pump systems", the method of connecting the rotor shaft to the impeller
22 shaft is with a rigid screw-coupling. Examiner is clearly viewing such a system as
23 having a separate motor driving a separate pump. Examiner also states that an
24 impeller, rotor and coupling are all prior art. For pumping systems where the
25 pump and the motor are separate units, this assessment is generally accurate
26 subject to the provisos of Section 2-C above.

27 However, for the AC PMSM pumps of amended Claim 3, wherein the rotor
28 and impeller are an integral unit which is immersed in a common liquid, fixing the

1 rotor and impeller so that they cannot rotate with respect to each other is **not**
2 normal or common practice. Rather, the common and normal practice is to allow
3 the impeller to have a limited degree of free rotation in both directions with
4 respect to the rotor. [see for example Cabalcante (US4247265), Ellis, et al (US
5 5282961) and Willinger and Ivasauskas (US4861468)]. A common example of
6 an AC PMSM submersible motor pump in wide U.S. distribution with this type of
7 rotor/impeller coupling is the Rio® Aqua Pump 200 distributed in the U.S. by
8 T.A.A.M., Inc., Camarillo, California. Without the limited-free-rotation of the rotor
9 and impeller, pumps of this type will not reliably start upon being energized with a
10 sinusoidal voltage from the AC line. This is due in part to the resistive force on
11 the impeller due to the static water head and due to the typically low startup
12 torque of such motor pumps. In these motor pumps, by allowing a limited degree
13 of free rotation of the impeller with respect to the rotor, the rotor is allowed to
14 begin rotation without the resistance of the impeller. Also, due to the smooth
15 sinusoidal nature of the AC source, rotor/impeller chatter is eliminated when
16 these motor pumps are driven at their design frequency from the AC line.

17 Amended Claim 3 teaches away from the above accepted practice of
18 limited-free-rotation of rotor and impeller in the prior art for such motor pumps,
19 which in itself is a compelling argument against a §103(a) rejection.

20 Regarding amended Claim 3, if the controller of amended Claim 1 upon
21 which Claim 3 depends, were coupled with the limited-free-rotation rotor/impeller
22 of the prior art described above, objectionable impeller chatter would result
23 especially in the lower range of realizable pump speeds. This would be
24 exacerbated by the pulse nature of the switching signals of amended Claim 1
25 (which are not sinusoidal), back pressure from the water head and the non-
26 directional preference of the motor pump.

27 Regarding §102(b) novelty, rotor chatter is effectively eliminated with the
28 fixed rotor/impeller of amended Claim 3 when coupled with the controller of

1 amended Claim 1. This allows the motor pump to function smoothly over the
2 realizable range of motor pump speeds and associated pump flow rates. Also
3 novelly, the controller of amended Claim 1 and the fixed rotor and impeller of
4 amended Claim 3 result in reliable motor pump startup which is not the case if
5 the motor pump is driven directly from the sinusoidal AC line and the rotor and
6 impeller is fixed to prevent relative rotation. The reliable starting behavior of
7 motor pumps of Claim 3 is a demonstrable consequence of driving the motor
8 pump with a pulse waveform of the type generated by the controller of amended
9 Claim 1.

10

11 **5. Rejection of Claim 8 under §103(a) over Ramarathnam in view of**
12 **Joyner, Jr. et al is overcome**

13 Claim 8 has been amended to specifically interface a DMX control signal
14 to the controller. Applicants' disclosure (pg. 8, lines 18-21) references a DMX
15 signal to set the instantaneous desired pump flow rate. A single DMX controller
16 can be used to independently control up to 512 separate motor pumps based on
17 a complex set of pre-programmed external events. Such DMX controllers are
18 used extensively to control multi-media and stage presentations. Claim 8 is novel
19 in that it allows a motor pump to be interfaced to a complex pre-programmed
20 external system. It would be a strained interpretation to rely on the "read set
21 speed" step in Ramarathnam's Fig. 9 to base a potential §103(a) rejection of
22 amended Claim 8. The "read set speed" step in Ramarathnam's Fig. 9 simply
23 sets the speed from the operator console or keypad (pg. 9, lines 24-25).

24

25 **6. Rejection of Claim 10 under §103(a) over Ramarathnam in view of**
26 **Joyner, Jr. et al is overcome**

27 Claim 10 has been amended to enunciate the patentable features of the
28 software program disclosed in applicants' Fig. 3 and described in applicants'

1 disclosure. Amended Claim 10 distinguishes over **Ramarathnam** and over the
2 prior art. Specifically, the program of amended Claim 10 computes AC pulse
3 switching signals "*... as required to synchronously drive said motor pump at the*
4 *frequency of said AC pulse switching signals and with said AC pulse switching*
5 *signals having a pulse width as required to maintain synchronization of said*
6 *motor pump with said AC pulse switching signals over all realizable speeds.*"
7 This language distinguishes over **Ramarathnam** and over the prior art.
8 Specifically, the flow chart in **Ramarathnam's** Fig. 9 computes a sine wave
9 generated by a PWM frequency considerably higher than the motor driving
10 frequency. It would be a strained interpretation of "program" to describe
11 **Ramarathnam's** program with amended Claim 10. While the program in
12 amended Claim 10 and in **Ramarathnam** both affect a change in motor speed,
13 they do so in substantially and patentably distinguishable ways. This distinction is
14 clearly made in amended Claim 10.

15

16 **7. Rejection of Claim 12 under §103(a) over Ramarathnam in view of**
17 **Slate et al is overcome**

18 Claim 12 originally depended on Claim 2 (now cancelled). Claim 12 has
19 been amended to depend on amended Claim 3 which incorporates the subject
20 matter of cancelled Claim 2 with further limitation. Amended Claim 3 depends on
21 amended Claim 1.

22 Regarding **§103(a)** rejection of Claim 12, Examiner states that
23 **Ramarathnam** does not teach a fountain system but **Slate et al** does. Because
24 **Slate et al** requires a motor driver, Examiner contends that "it would have been
25 obvious to a skilled person to use Ramarathnam's motor to run the fountain
26 system of Slate to achieve the same subject matter."

27 **Slate, et al** does not teach a fountain system. **Slate et al** teach an
28 intermittently driven piston pump coupled to separate DC motors and used to

1 feed a fluid cassette in a patient fluid delivery system. This system would be
2 wholly inappropriate to drive a fountain as enunciated in Claim 12 or for that
3 matter any fountain designed for generating variable output flow patterns.
4 Moreover, **Slate et al** specify a feedback controller which cannot cause a
5 variation in output of an AC PMSM pump as in Claim 12.

6 **Ramarathnam** teaches a motor controller - not a motor. **Ramarathnam's**
7 motor controller is designed to control an AC motor - not a DC motor as
8 disclosed in **Slate et al.** (See earlier argument {Section 2-A} regarding DC
9 motors driven as AC motors.)

10 Combining the AC control of **Ramarathnam** to replace the motor driver in
11 **Slate et al** would result in an in-operative combination: **Ramarathnam's** AC
12 control would not control the **Slate et al** DC motors without the atypical
13 modifications required to turn the **Slate et al** motors into AC motors. One could
14 also argue that it would be impossible to combine the two cited references to any
15 practical effect.

16 Furthermore, each of the references cited by Examiner is complete within
17 itself. There is no reason to combine the two references - especially in light of
18 the above arguments. These are strong arguments against a §103(a) rejection.

19 Novelty, the fountain of amended Claim 12 attains an exquisite degree of
20 control with only one moving part - the rotor in the AC PMSM pump! Using the
21 sine wave control of **Ramarathnam**, although not suggested by Examiner, would
22 result in substantial processor overkill and associated increased cost to control
23 what is essentially a low cost submersible pump. Beyond this argument,
24 amended Claim 12 results in a substantial improvement in implementation, cost
25 and fountain maintainability over the commonly accepted dynamic fountain art of
26 utilizing motor, pump, controller, electrically actuated valves, holding tanks and
27 plumbing to perform the same task.

28

1 **8. Objection of Claims 4, 7 and 13 as being dependent on a rejected
2 base claim is overcome**

3 Examiner rejected Claims 4, 7 and 13 as being dependent on a rejected
4 base claim (Claim 1). Claim 1 has been amended and based on applicants'
5 arguments, applicants submit that amended Claim 1 is clearly allowable over the
6 prior art. Applicants respectfully request that Claims 4, 7, and 13 be granted as
7 objections to base Claim 1 have been addressed and overcome.

8

9 **9. Request for Reconsideration**

10 Claim 1 was amended to further enunciate the unique features of the
11 invention, to further distinguish from the prior art and to more specifically
12 overcome §103(a) objections based on **Ramarathnam** and **Ramarathnam** in
13 view of **Joyner, et al.**

14 Claim 3 was amended to include the subject matter of cancelled Claim 2
15 with further limitation to liquid immersed rotor/impellers and to overcome §103(a)
16 objections based on the prior art especially relative to coupling separate motors
17 and pumps.

18 Claim 8 was amended to limit to DMX control and to overcome §103(a)
19 rejection based on **Ramarathnam**.

20 Claim 10 has been amended to enunciate the patentable features of the
21 software program and to overcome §103(a) objections over **Ramarathnam**.

22 Claim 12 was amended to depend on amended Claim 3 and to overcome
23 §103(a) arguments based on **Ramarathnam** in view of **Slate et al.**

24 Dependent Claim 4, 7 and 13 depend on amended Claim 1 for which
25 §103(a) arguments have been addressed and overcome. Applicants submit that
26 Claims 4, 7 and 13 are now in condition for allowance.

10. Conclusions and Request for Constructive Assistance

3 Based on all the arguments forwarded by the applicants to counter
4 Examiner objections and based upon changes to the claims to more clearly
5 enunciate the novel and patentable features of the invention, the applicants
6 submit that amended Claims 1, 3, 8, 10 and 12 all define patentably over the prior
7 art and are clearly allowable. Applicants also submit that Claims 4, 7 and 13 be
8 granted as the basis for rejection has been corrected. Therefore applicants
9 submit that this application is now in condition for allowance, which action they
10 respectfully solicit.

If for any reason this application is not believed to be in full condition for allowance, applicants respectfully request the constructive assistance and suggestions of the Examiner pursuant to M.P.E.P. §21783.02 and §707.07(j) in order that applicants can place this application in allowable condition as soon as possible and without the need for further proceedings.

16

17 Very Respectfully,

18

19 Chris S. Brunt  Gary R. Fisher 
20 Applicants Pro Se

21

22 Dated: 15 AUGUST 2003

23

24 2240 Federal Avenue
25 Los Angeles, CA 90064
26 310-477-8960

27

28

29

1 **C**ertificat of Mailing

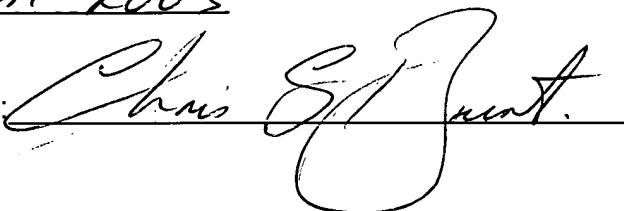
2 I hereby certify that this correspondence and attachments, if any, will be deposited with the
3 United States Postal Service by Express Mail # ET557029455US, postage prepaid, in an
4 envelope addressed to: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria,
5 VA 22313-1450 on the date below.

6

7 Date: 15 August 2003

8

9 Inventor's Signature:

A handwritten signature in black ink, appearing to read "Chris S. Brunt". The signature is fluid and cursive, with "Chris" and "S." being more stylized and "Brunt" being more clearly legible at the end.